# Operating instructions/ Suggested uses
# Digital multimeter, Order no. 10002896

Congratulations on purchasing a Rothewald digital multimeter. This is a battery-powered manual multimeter that can be used for measuring DC and AC voltages, current strengths and resistances and also for testing diodes.
A protective cover with built-in stand and two test cables are included.
Please follow all the operating and safety instructions to ensure that the unit is used safely and to keep it in good condition.
Before using this unit with your bike or car, consult your vehicle's repair and maintenance manual for the requisite measured values and model-specific measurement instructions.
Improper use of this multimeter may result in damage to the device itself or to your vehicle!

**Control panel**

1: 15 mm high LCD display, 3 1/2 digit.
2: Rotary switch for On/Off, and for selecting function and measuring range.
Clockwise rotation selects the following functions / ranges:
Off; AC voltmeter 600 V, 200 V; DC ammeter 20 µA, 200 µA, 2 mA, 20 mA, 200 mA, 10 A; diode testing; ohmmeter 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ; DC voltmeter 200 mV, 2 V, 20 V, 200 V, 600 V.
3: Hold function: if "Hold" is pressed, the display will retain the last measured value and will indicate this with an "H" symbol until "Hold" is pressed again.
4: 10 A jack, unfused: insert the positive test cable (red) here to measure currents in the 10 A measuring range.
5: COM jack: insert the negative test cable (black) here.
6: VΩmA jack: insert the positive test cable (red) here to measure voltage, resistance and DC (up to 200 mA, fused).

**Technical specifications**

Display accuracy is guaranteed for a period of one year following calibration at temperatures between 18 and 28°C and at up to 80% humidity.

| | |
|---|---|
| Fuse: | F 200 mA / 250 V |
| Battery: | 9V battery |
| Display: | 3 1/2 digit, 15 mm high LCD |
| | 2-3 updates / sec. |

| | |
|---|---|
| "Measuring range exceeded" message: | number "1" appears on the display |
| "Reversed polarity" message: | "-" appears on the display |
| "Low battery" message: | battery symbol appears on the display |
| Operating temperature: | 0 to 40°C |
| Storage temperature: | -10 to 50°C |
| Max. humidity for storage: | 80%, non-condensing |
| Dimensions: | 138 x 69 x 31 mm |
| Weight: | approx. 160 g |

| Mode | Measuring range | Resolution | Accuracy |
|---|---|---|---|
| DC voltage | 200 Mv | 0.1 mV | +/-(0.5% +/-2 dgts) |
| | 2 V | 1 mV | +/-(0.5% +/-2 dgts) |
| | 20 V | 10 mV | +/-(0.5% +/-2 dgts) |
| | 200 V | 100 mV | +/-(0.5% +/-2 dgts) |
| | 600 V | 1 V | +/-(0.8% +/-2 dgts) |
| AC voltage | 200 V | 100 mV | +/-(1.2% +/-10 dgts) |
| | 600 V | 1 V | +/-(1.2% +/-10 dgts) |

AC voltage frequency 40 to 400 Hz

| | | | |
|---|---|---|---|
| DC current | 20 µA | 0.01 µA | +/-(1% +/-2 dgts) |
| | 200 µA | 0.1 µA | +/-(1% +/-2 dgts) |
| | 2 mA | 1 µA | +/-(1% +/-2 dgts) |
| | 20 mA | 10 µA | +/-(1% +/-2 dgts) |
| | 200 mA | 100 µA | +/-(1.5% +/-2 dgts) |
| | 10 A | 10 mA | +/-(3% +/-2 dgts) |

10 A for 10 s, 15 mins cool-down period

| | | | |
|---|---|---|---|
| Resistance | 200 Ω | 0.1 Ω | +/-(0.8% +/-3 dgts) |
| | 2 kΩ | 1 Ω | +/-(0.8% +/-2 dgts) |
| | 20 kΩ | 10 Ω | +/-(0.8% +/-2 dgts) |
| | 200 kΩ | 100 Ω | +/-(0.8% +/-2 dgts) |
| | 2M kΩ | 1 kΩ | +/-(1.0% +/-2 dgts) |

**Important safety notes**

**Important safety notes for users:**

- This measuring instrument must not be used if damaged. Check that the test probes, their connections and insulation are all in good condition. Only use the test cables that were supplied with the unit. Never work in wet or very humid conditions, if the air contains dust, flammable gases, vapours or solvents, in thunderstorms, or near powerful electromagnetic fields.
- If the instrument is moved from a cold into a warm environment condensate may form inside it. It should not therefore be switched on until it has reached **room temperature**.
- Always select the measurement function and range carefully. Never exceed the **measuring range**. If there is any doubt regarding the measuring range to be set, then you should start by choosing the widest range possible.
- Always disconnect test cables before switching between the different **measurement functions** of voltage, current and resistance. Likewise, always disconnect the test cables before switching off.
- In the case of **voltage measurements** there should never be any components connected to the hFE jack.

If you switch from one measuring range to another whilst measurement is in progress, voltage peaks might occur and damage the instrument.
If the voltage exceeds 60 V three-phase or 25 V AC, it is important to take particular care as there is a risk of electric shock. The test object should therefore first be de-energised, then the measuring range selected and the measuring instrument connected to the test object. Only then should voltage be applied to the test object. Whilst measurement is in progress keep your fingers behind the shielding on the insulated handle.
Do not use this multimeter for measuring voltage if voltages of above 600 volts are likely to develop. Do not use this multimeter for measurements in domestic distribution systems or three-phase networks (380/400 V). Measurements on a 230 V network (e.g. domestic power circuit) are permissible.
- **Current strength** up to 10 A can be measured. The 10 A range is not fused, and therefore measurement in this range must only be carried out on circuits equipped with their own fuses. No voltages of above 250 V are allowed. A measurement of 10 amps should only continue for 10 s, and must be followed by a 15 minute cool-down period.
- Never perform **resistance measurements** on live components.

**Maintenance:**

If the display is blank, possible causes are:
- the multimeter is not switched on
- the battery is flat ("Battery" indicator may appear on the display)
- the rotary switch may be positioned incorrectly (between two positive positions)
- If it not possible to measure current, the fuse for the 200 mA range may be faulty.

Before opening the unit to change the battery or fuse, always unplug the test cable first and move the rotary switch to "Off". Now, using a suitable Philips screwdriver, unscrew and remove the Philips screws from the rear side of the housing and lift off the lower half of the housing.
- Using the wrong fuse can result in fire. You must therefore only ever use a fuse with the following specification:
F 200 mA / 250 V ("flink")

- Replace the battery with another one of the same type (9V battery). Be careful to connect the leads the right way round.
Always close up the housing carefully and tighten all the fastening screws before starting to use the multimeter again.
Use a damp cloth and a mild cleaning agent to clean the device. Never use abrasives or solvents

**Using the multimeter**

**A. Measuring a DC voltage:**
**Important: Never exceed the permissible measuring range of 600 V DC! Never touch a circuit or components in a circuit if the voltage being measured is above 25 V AC or 35 V DC!**
1. Connect the red test cable to the "VΩmA" jack and connect the black one to the "COM" jack.
2. Set the rotary switch to the relevant measuring range "V – straight line". If there is any doubt at first regarding the measuring range, start with greatest measuring range and then reduce it a little at a time until the ideal measuring range is found. If any measured value appears on the display although the test probes have not yet been connected to the object, this can be attributed to the sensitivity of the measurement input and of no importance.
3. Connect the test probes to the measurement object. If an "-" appears on the display, this indicates that you have reversed the polarity.
4. Now read the measured value off, retaining it if necessary with the "Hold" button.

**B. Measuring an AC voltage**
**Important: Never exceed the permissible measuring range of 600 V AC! Never touch a circuit or components in a circuit if the voltage being measured exceeds 25 V AC!**
1. Connect the red test cable to the "VΩmA" jack and connect the black one to the "COM" jack.
2. Set the rotary switch to the relevant measuring range "V – wavy line". If at first there is any doubt about the measuring range, start with the highest

measuring range and then reduce it as required. If any measured value appears on the display although the test probes have not yet been connected to the object, this can be attributed to the sensitivity of the measurement input and of no importance.
3. Connect the test probes to the measurement object. If an "-" appears on the display, this indicates that you have reversed the polarity.
4. Now read the measured value off, retaining it if necessary with the "Hold" button.

**C. Measuring a DC current**
**Important: Do not measure current in circuits in which voltages greater than 250 V DC can occur!**
**Do not attempt to measure currents greater than 10 A – the multimeter would overheat!**
**Currents of 10 A must only be measured for 10 s, after which the unit should be disconnected for approx. 15 minutes (cool-down period)!**
1. Connect the black test cable to the "COM" jack. For measurements in the mA range below 200 mA, the red test cable is connected to the "VΩmA" jack, but for measurements greater than 200 mA, it is connected to the "10 ADC" jack.
2. Move the rotary switch to the desired measuring range "A". If there is any doubt regarding the measuring range, start with the largest measuring range and then reduce it (see A. 2.).
3. Connect test probes to the measurement object as shown in the diagram.
4. Read measured value off, retaining it if required with the "Hold" button.

**D. Measuring resistance**
**Important: It is essential that the measurement object should be de-energized!**
**To obtain reliable measured values the object's contact points must be free from dirt, oil, solder lacquer, etc!**
1. Connect the black test cable to the "COM" jack and the red test cable to the "VΩmA" jack. Move the rotary switch to the desired measuring range "Ohms".

2. Select 200 ohms as the measuring range, hold test probes close together in order to check the test cable for continuity. The unit should be displaying 0.1 to 0.3 ohms. Now choose the measuring range for the test object (see A. 2.).
3. Hold the test probes near the object and read the measured value off, retaining it if required with the "Hold" button. If values over 1 ohm are obtained it may be wise to first wait until the reading has stabilised.
4. If the resistance being measured is connected to a circuit, switch the instrument off and discharge all capacitors before applying the test probes.

**E. Testing diodes**

**Important: The test object MUST be de-energized, and any connected capacitors must be discharged!**

1. 1. Connect the black test cable to the "COM" jack and the red test cable to the "VΩmA" jack.
2. Move the rotary switch to the "Arrow Symbol" function.
3. Hold the red test probe against the diode's anode and the black test probe against its cathode. Now read off the value for the conducting-state voltage (values between approx. 0.6 V and 3 V depending on diode type). The diode "blocks" the voltage in one direction – in the "blocked direction" you will obtain the value "1". If there is again a conducting-state voltage despite reversing the test probes, this indicates that the diode is faulty.

If you have any questions about these instructions, for prompt assistance please contact our fax service hotline on +49 40 73419358 before you assemble or use the product. This is the best way to ensure that your product is assembled properly and used correctly.
Detlev Louis Motorradvertriebs GmbH 21027 Hamburg, Germany
http://www.louis.de

**Suggested uses for the digital multimeter**

Some suggested uses for the digital multimeter with your motorcycle can be found below.

When you perform these procedures yourself, be sure to always follow the safety instructions for using the unit (see user instructions); model-specific details and target measurement values can be found in the repair and maintenance manual for your particular vehicle. While we have carefully researched all the instructions and reviewed them several times, you will understand that we accept no liability.

**1. Check charging circuit**

The charging circuit ensures that there is a power supply to the battery and all consumers (ignition, lights, etc.) on the bike.

- If there are indications that the alternator is not charging the battery sufficiently (e.g. the headlight is dimming or the battery charging indicator light is flickering), start with a visual inspection of all the accessible components of the charging circuit: plug connections should be secure and clean, cables must not show any sign of damage, wear or fire, the alternator and regulator/rectifier should not exhibit any obvious signs of mechanical defect.
- To test the individual components further the battery should be in good condition and fully charged.
- If you identify a fault in part of the charging circuit, also check all the other components of the circuit for damage.

**1.1 Charging voltage**

The charging voltage measurement reveals whether or not the charging circuit is working correctly. First warm the engine up. Now put the bike on its stand and make the battery terminals accessible. Allow the engine to idle. Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter. Select 20 V DC measuring range. Hold the red test probe against the positive and the black test probe against the negative battery terminal. Read off the value – for a well charged 12 V battery the display should now be indicating approx. 12.6 volts. Now, depending on the model of bike, increase the engine speed to around 3000-4000 rpm. With a 12 volt system the reading should now increase to approx. 13.5 to 15.5 volts; in this case the alternator is charging correctly. If, on the other hand, the voltage stays the same, then there is a fault in the charging circuit. If the voltage increases beyond the range 13.5

to 15.5 volts when the engine speed is increased, this indicates that the voltage regulator/rectifier is not limiting the voltage correctly. Measurable short-term voltage peaks indicate a fault in the rectifier and/or the alternator.

### 1.2 Testing a star alternator with a permanent magnet rotor

Star alternators operate with a permanent magnet rotor that induces a voltage by turning in the windings of the outer stator. They rotate in an oil bath, usually on the crankpin.
Faults generally occur as a result of persistent overheating or overloading of the regulator.

#### Testing non-rectified charging voltage

Stop the engine and switch the ignition off. Disconnect the plug on the cable harness leading from the alternator to the regulator/rectifier. Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range up to 200 V AC. Use the test probes to connect two of the alternator's plug contacts. Leave engine running at approx. 3000-4000 rpm. Measure voltage, stop engine, connect test probes across different contacts, restart engine, measure voltage again, and so on ... If the measured values are the same for all the combinations of contacts (as a rule an average motorcycle alternator delivers approx. 50-70 volts), then the alternator is working correctly. If some of the measured values are significantly below the others, the alternator is faulty.

#### Checking for a short circuit to earth and interturn fault

Stop the engine and switch the ignition off. Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range 200 ohms and hold the test probes close together for the continuity test until a value of 0.1 to 0.3 ohms is indicated. Now hold the black test probe against earth and the red one against all the plug contacts one after the other. There must be no measurable continuity (infinite resistance) otherwise the stator would have a short circuit to earth. Then use the test probes to test all possible combinations for connecting the contacts – the resulting value should always remain slightly less than 1 ohm. If the measured value is too high, this indicates insufficient continuity between the windings,

while a measured value of 0 would indicate a short circuit. In both cases the stator would be faulty.
If the AC voltage at the alternator is considerably too low despite the fact that the alternator windings are undamaged, it can be assumed that the rotor is demagnetised.

**Testing the regulator/rectifier**

If a charging voltage of more than 15 V is measured at the battery when the engine is running at high revs, either the voltage regulator is faulty (see above) or it needs to be re-adjusted (some older regulators are adjustable). A rectifier should be disconnected from its circuit before testing. Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range 200 ohms and hold the test probes close together for the continuity test until a value of 0.1 to 0.3 ohms is indicated.
Now measure the resistance in both directions between the rectifier's earth cable and all the alternator connections and also between the positive output cable and all connections (in other words reverse the polarity once in each case). One direction should produce a lower reading while the other direction should produce a reading that is at least 10 times as high. If any of these connections produces the same value in both directions (i.e. despite reversal of polarity), this indicates that the alternator is faulty and must be replaced.

**1.3 Testing a collector alternator**

Collector alternators do not use permanent magnets to induce current; instead they use the electromagnetic energy from an external field winding. This is picked up by carbon brushes at the rotor collector. This type of alternator always runs "dry", either on the crankshaft stump with an external regulator or as a separate unit, in which case it will usually have an integrated regulator. Faults are generally caused by vibrations, by shaking due to the rotor's transverse acceleration, or by asymmetrical thermal stresses. The carbon brushes and collector are subject to long-term wear.

**Testing the regulator/rectifier: as described in 1.2**

If you intend to test your **separate collector alternator** thoroughly it is advisable to remove it from the bike (first disconnect the battery) and then dismantle it. Then check the contact pressure of the brush springs and the length of the carbon brushes and replace them if necessary. Clean the collector with petrol and rub it down with fine sandpaper if necessary. Check depth of collector grooves (approx. 0.5 - 1 mm), recut them with a sawblade if necessary or replace the rotor if the slipring has reached its limit of wear.

Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range 200 ohms and hold the test probes close together for the continuity test until a value of 0.1 to 0.3 ohms is indicated. Now test for continuity at the stator windings, hold one test probe before and one after a field winding – a small resistance should be measured. A large resistance indicates a line break while resistance close to zero means that there is a short circuit. To check for a short circuit to earth select measuring range up to 2 MOhm. Hold the red test probe against that stator winding and the black one against the housing (earth). Unless the resistance measured is infinite there is a short to earth (fault).

Next, measure the resistance between all possible combinations of commutator bars on the rotor. The measured resistance should always be low; a value close to zero indicates a short circuit while a high resistance indicates a line break requiring the rotor to be replaced. Select measuring range up to 2 MOhm on the multimeter. Hold the red test probe against a commutator bar and the black one against the axle (earth). Unless the resistance measured in each case is infinite there is a short to earth (rotor fault).

**Alternators mounted on the crankshaft stump** do not need to be removed for testing. You only need to disconnect the battery and remove the alternator cover in order to check the collector, rotor and stator. The collector does not have any grooves. There should be no engine oil and no rainwater in the alternator chamber (replace seals as required). The stator windings are checked for continuity at the relevant cable connections as described above. The rotor windings are tested directly between the two copper tracks of the collector (as described). The measured resistance must be small (approx. 2 –

6 ohms). If it is approaching zero, there is a short circuit, and if it is large there is a break in the winding. The resistance measured to earth, on the other hand, must be infinite.

## 2. Checking the ignition circuit of a battery coil ignition

### 2.1 Ignition coils

If ignition sparks are either weak or non-existent, start with a visual inspection of the cable connections and spark plug. If thin, burned looking wires can be seen on the coil housing, they could be current creepage paths that could be caused by dirt or material fatigue of the coil body. Old spark plugs should be replaced. To test the quality of the ignition spark in contact ignition, remove a spark plug from each ignition cable, hold the cable at a distance of 5 - 7 mm from the engine earth (wear a glove), switch on the ignition and follow the start procedure. The spark should jump across this gap (the spark from a really good coil will jump 10 mm or more). With an electronic ignition unit the test just described is carried out with the help of a spark tester to avoid the risk of damage to the black box. A weak ignition spark may (especially with older vehicles) be due to a voltage drop in the ignition circuit. For safety reasons, checking the ignition coils in an electronic ignition system should be left to a professional mechanic to avoid risk of damage to the black box. In the case of contact ignition, proceed as follows:
Select the measuring range 20 V DC on the multimeter. Undo the positive and negative cables from the coil, hold the black test probe against minus (lead to contact, contact position "closed") and the red test probe against plus (from the kill switch). The measurable voltage must be 12 volts (apart from rare cases in which there are advance resistances in the ignition circuit). If the measured value is smaller than this, there is a fault on the feed cables (e.g. verdigris in the cable core), a plug, the kill switch or ignition lock. In this event damaged cables should be replaced and plugs and switches tested for contact resistances. To do this, disconnect the battery, set the multimeter to measuring range 200 ohms, carry out a continuity test (see above), hold test probes against the cable accesses for the switch or plug. If the measured value is greater than approximately 0 ohms, this indicates faults, dirt or corrosion damage. Clean

components as far as possible, apply a little contact spray and then measure again.
The ignition coil itself can be tested with the multimeter for line break and short circuit but not for interturn faults or disruptive discharges at high voltage. There is another factor to consider, namely that ignition coils frequently do not start to malfunction until a certain operating temperature has been reached.
To test a coil, disconnect it from the vehicle electrics. Set the multimeter to measuring range 200 ohms, perform a continuity test (see above), hold the red test probe against the positive and the black one against the negative terminal, then compare the result with the setpoint value for the coil's primary winding as specified in the workshop manual. Then set the measuring range of the multimeter to 20 kOhms and test the secondary winding: with a double ignition coil the test probes are held against the two high-voltage ignition cables, with an ignition coil with ignition cable hold the red test probe against the positive feed and the black test probe against the high-voltage ignition cable, then compare the measured value with the setpoint value from the workshop manual.

### 2.2 Ignition box

Ignition boxes are extremely sensitive components and should only ever be tested by a workshop that has the relevant special testing device.

### 2.3 Pulse generator coils

Electronic ignition systems receive their pulse from a rotor finger that is usually attached to a crankpin and activates a pulse generator coil. To test this coil set the multimeter to measuring range 2 KOhms, perform a continuity test (see above), disconnect the pulse coil, hold the test probe against the connections and compare the measured value with the workshop manual. A resistance that is too high points to a line break, while one that is too low points to a short circuit. Now adjust the multimeter to 2 MOhm and measure the resistance between the winding and earth – unless it is infinite there is a short to earth and the coil must be replaced.

## 3. Testing the starter circuit

### 3.1 Starter relay

The purpose of the starter relay is to reduce load on the cabling and switches in the starter circuit. To test it, first disconnect the thick cable leading to the starter. Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range 200 ohms and perform continuity test (see above). Hold test probes against the relay connections "Minus" and "Connection to switch". Turn on the ignition, if necessary actuate the safety switch on the clutch or side stand, then press the starter button. The relay should now "click" and a resistance of 0 ohms be measured. If the resistance is greater than 0 ohms, the relay is probably faulty even if it clicks.
Now select the measuring range 20 V DC on the multimeter. Disconnect the "Minus" cable from the relay, hold the black test probe against it, likewise disconnect the "Switch connection" cable from the relay and hold the red test probe against it. The measured voltage should be 12 volts. A measured voltage that is lower than this indicates a fault on the feed cable, a plug, the starter button or a safety switch (voltage drop).
The switches can be tested by disconnecting their cable accesses from the circuit. Set the multimeter to measuring range 200 ohms, perform continuity test (see above), hold test probes against the cable accesses and actuate the switch. If the measured value is greater than 0 ohms, this indicates a faulty switch (clean it if possible, apply a little contact spray and then measure again).

### 3.2 Starter

Disconnect battery, remove starter from the motorcycle and dismantle it. Check the contact pressure of the brush springs and the length of the carbon brushes and replace them if necessary. Clean the collector with petrol and rub it down with fine sandpaper if necessary. Check depth of collector grooves (approx. 0.5 - 1 mm), recut them with a sawblade if necessary or replace the rotor.
Insert the red test cable in the VΩmA jack and the black cable in the COM jack on the multimeter, select measuring range 200 ohms and perform continuity test (see above). Measure the resistance between all possible pairs of commutator bars on the rotor. The measured resistance should always be low; a value close

to zero indicates a short circuit while too high a resistance indicates a line break requiring the rotor to be replaced. Now select measuring range up to 2 MOhm on the multimeter. Hold the red test probe against each commutator bar and the black one against the axle (earth). Unless the resistance measured in each case is infinite there is a short to earth and the rotor should be replaced.
If the stator on the starter has field windings instead of permanent magnets, they should likewise be tested for shorts to earth (if the resistance between earth and field winding is not infinite, replace winding) and for continuity (the resistance in the winding should be small, see above).

## 4. Testing the cable harness, switches, etc.

### 4.1 Switches, plugs, ignition locks, wiring harnesses

With the passage of time corrosion and dirt can build up large contact resistance in plugs and switches; cable harnesses that are affected by the "electrical bug" make poor conductors. In extreme cases, this can result in a component becoming completely disabled, whilst less serious damage can more or less noticeably reduce the efficiency of affected consumers such as lights or ignition.
A simple visual inspection of components is often all that is required: green connector tongues and scruffy switch contacts must be scraped or sanded clean and reassembled with a little contact spray. Cables with greenish cores should be replaced. A cable cross section of 1.5 is generally sufficient on a motorcycle, although slightly thicker cable is used for the main positive leads and the cable connecting the battery with the starter relay and the starter cable itself have specific dimensions.
Exact information on a cable's conductivity is provided by a resistance measurement. To do this, disconnect the battery, set the multimeter to measuring range 200 ohms, carry out a continuity test (see above), hold test probes against the cable accesses for the switch or plug (switch in the ON position). If a resistance greater than approximately 0 ohms can be measured, this indicates faults, dirt or corrosion damage.
Measuring the drop in voltage can also provide information on the quality of power supply to a component. This can be done by selecting the measuring

range 20 V DC on the multimeter. Disconnect positive and negative leads from the consumer and hold the black test probe against the negative and the red one against the positive lead. The measurable voltage should be 12 volts – readings below this suggest energy losses.

**4.2 Leakage currents**

Leakage currents at the ignition lock, switches, connectors and cables can "suck" the power from a bike battery until sooner or later it becomes totally flat. A leakage current can be revealed with a test lamp or by using the multimeter to measure current. Remember that, to avoid overheating, your multimeter must never be subjected to loads in excess of 10 A (see safety instructions). The multimeter must therefore on no account be used to measure current on the positive lead to the starter, on the thick battery cable to the starter relay or at the alternator.

In order to detect a leakage current, first turn the ignition off and disconnect the positive cable from the battery. Select the 10 amp measuring range on the multimeter, insert the red test cable in the 10 ADC jack and the black one in the COM jack, then hold the red test probe against the positive cable and the black test probe against the battery's positive terminal. If a current can be measured, this indicates that there is a leakage current. The source of the leakage current can be narrowed down by removing fuses from the bike one by one. The circuit whose fuse cancels out the reading on the measuring instrument is the source of the leakage current and must be investigated thoroughly.

Faulty diodes can also cause a leakage current by opening in an uncontrolled manner. This can be tested using the "Diode test" function on the multimeter.

If you have any questions about these instructions, for prompt assistance please contact our fax service hotline on +49 40 73419358 before you assemble or use the product. This is the best way to ensure that your product is assembled properly and used correctly.

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